

CLAIMS

What is claimed is:

1. An elongated sleeve structure for the insertion and protection of elongated items within an outer duct, said sleeve structure comprising a flexible sleeve comprised of a pair of opposed layers of woven resilient filaments comprised of warp yarns and a fill yarn common to both layers, said layers having a common seamless edge and a second edge, the layers being joined along the second edge by a knit stitch formed by interlooping of successive traverses of said fill yarn, said layers being of equal width and being resiliently separable from a first position in which they are in a closely spaced relationship to a spaced apart relationship in which a plurality of said elongated items may be accommodated, said layers being resiliently biased to return to said first position in the absence of any said elongated items.

2. An elongated sleeve structure according to Claim 1, wherein said warp and fill yarns consist essentially of polyester.

3. An elongated sleeve structure according to Claim 2, wherein said warp yarns comprise monofilaments having a diameter of about 0.25 mm.

4. An elongated sleeve structure according to Claim 3, wherein said fill yarns comprise monofilaments having a diameter of about 0.20 mm.

5. An elongated sleeve structure according to Claim 4, wherein said sleeve has a weave density of 20 to 35 dents per inch by 20 to 35 picks per inch.

6. An elongated sleeve structure according to Claim 2, wherein said warp and fill yarns are woven in a pattern selected from the group consisting of satin, sateen and twill weaves.

7. An elongated sleeve structure according to Claim 1, wherein one of said warp and said fill yarns comprise polyester.

8. An elongated sleeve structure according to Claim 7, wherein one of said warp and said fill yarns further comprise nylon.

9. An elongated sleeve structure according to Claim 7, wherein one of said warp and said fill yarns further comprise polypropylene.

10. An elongated sleeve structure according to Claim 1, wherein said warp and fill yarns comprise aramid filaments selected from the group consisting of nylon, polyphenylene sulfide, polyvinylidene fluoride, and copolymers of ethylene and chlorotrifluoroethylene.

11. An elongated sleeve structure according to Claim 1, wherein said warp and fill yarns have substantially the same color as one another, an additional filamentary member being interwoven with said warp yarns substantially lengthwise along said sleeve and having a color contrasting with said warp and fill yarns.

12. An elongated sleeve structure according to Claim 1, further comprising an electrically conducting layer substantially coextensive with said sleeve.

13. An elongated sleeve structure according to Claim 12, wherein said electrically conducting layer comprises aluminum foil.

14. An elongated sleeve structure according to Claim 12, wherein said electrically conducting layer comprises a plurality of interlaced conductors.

15. An elongated sleeve structure according to Claim 12, wherein said electrically conducting layer is positioned between said pair of opposed layers.

16. An elongated sleeve structure according to Claim 12, wherein said electrically conducting layer comprises electrically conducting filaments interwoven with said warp and said fill yarns.

17. An elongated sleeve structure according to Claim 1, further comprising a pull tape positioned between said opposed layers and extending substantially along the length of said sleeve.

18. An elongated sleeve structure according to Claim 17, wherein said pull tape has a substantially flat cross-sectional shape.

19. An elongated sleeve structure according to Claim 17, wherein said pull tape is formed of interlaced filamentary members.

20. An elongated sleeve structure according to Claim 19, wherein said interlaced filamentary members comprise aramid fibers.

21. An elongated sleeve structure according to Claim 1, further comprising a flexible polymer coating positioned on said sleeve, said coating providing a substantially fluid-tight seal enabling inflation of said sleeve.

22. An elongated sleeve structure according to Claim 1, further comprising a binder yarn extending lengthwise along said second edge, said binder yarn having a plurality of loops surrounding said successive traverses of said fill yarns to facilitate closure of said second edge.

23. An elongated sleeve structure according to Claim 1, further comprising an attachment piece engaging said sleeve near an end thereof, said attachment piece being adapted to receive a line for drawing said sleeve through said outer duct.

24. An elongated sleeve structure according to Claim 23, wherein said attachment piece is adapted to attach said sleeve to a plurality of other said sleeves when said sleeves are arranged in overlying relation with one another.

25. An elongated sleeve structure according to Claim 23, wherein said attachment piece comprises a grommet, said grommet comprising:

a tube extending through said sleeve;

a flange attached to one end of said tube, said flange being positioned in engagement with one of said opposed layers; and

a ring positioned in engagement with another of said opposed layers, said ring being in overlying relation with said flange, said tube having a lip engaging and attaching said ring in said overlying relation with said flange.

26. An elongated sleeve structure according to Claim 25, wherein said lip is formed by cold-working said tube and forming an outward reverse fold therein.

27. An elongated sleeve structure according to Claim 25, further comprising a plurality of said sleeves positioned in overlying relation with one another in a stack, said tube extending through said plurality of sleeves and attaching said sleeves to one another, said flange engaging one of said sleeves uppermost in said stack, said ring engaging another of said sleeves positioned lowermost in said stack.

28. An elongated sleeve according to Claim 24, wherein said attachment piece comprises a suture extending through said opposed layers into engagement with at least another set of opposed layers of another of said sleeves thereby attaching said sleeves to one another.

29. An elongated sleeve structure according to Claim 24, wherein said attachment piece comprises a post extending through said opposed layers of said sleeve and through other opposed layers of another of said sleeves, a pair of cross pieces being attached at

opposite ends of said post, said cross pieces engaging said opposed layers and retaining said sleeves to one another.

30. An elongated sleeve structure according to Claim 29, further comprising a plurality of said posts and said cross pieces positioned in spaced relation lengthwise along said plurality of sleeves and joining said sleeves to one another, one of said posts and said cross pieces in each of said attachment pieces being frangible upon the application of a force separating said sleeves one from another.

31. An elongated sleeve structure according to Claim 2, wherein said filaments are woven in a pattern wherein said fill yarns float above two or more of said warp yarns.

32. An elongated sleeve for receiving elongated items, said sleeve comprising a flexible sidewall surrounding and defining a central space, said sidewall comprising polyester warp yarns interwoven with polyester fill yarns in a weave pattern selected from the group consisting of twill, satin and sateen weaves, opposing portions of said sidewall being in facing relation with one another to assume a substantially flat configuration, said opposing sidewall portions being separable into spaced apart relation to receive said elongated items within said central space.

33. A sleeve according to Claim 32, wherein said opposing sidewall portions are resiliently expandable into said spaced apart relation.

34. A sleeve according to Claim 32, wherein said warp yarns comprise monofilaments having a diameter of about 0.25 mm.

35. A sleeve according to Claim 34, wherein said fill yarns comprise monofilaments having a diameter of about 0.20 mm.

36. A sleeve according to Claim 35, wherein said sidewall has a weave density of about 20 to 35 dents inch by about 20 to 35 picks per inch.

37. A sleeve according to Claim 32, further comprising an electrically conducting layer positioned on said sidewall and surrounding said central space.

38. A sleeve according to Claim 37, wherein said electrically conducting layer comprises aluminum foil.

39. A sleeve according to Claim 37, wherein said electrically conducting layer comprises a plurality of interlaced metal wires.

40. A sleeve according to Claim 37, wherein said electrically conducting layer is positioned between said central space and said sidewall.

41. A sleeve according to Claim 32, further including an electrically conducting wire interlaced with said filamentary members lengthwise along said sidewall.

42. A sleeve according to Claim 32, further comprising a seam extending lengthwise along said

sidewall, said seam being closed by interknitted loops of said fill elements comprising said opposing sidewall portions with one another.

43. A sleeve according to Claim 42, further comprising a reverse fold positioned in said sidewall opposite to said seam.

44. A sleeve according to Claim 32, further comprising a pull tape positioned within said central space and extending substantially along the length of said sidewall.

45. A sleeve according to Claim 44, wherein said pull tape has a substantially flat cross-sectional shape.

46. A sleeve according to Claim 44, wherein said pull tape is formed of interlaced filamentary members.

47. A sleeve according to Claim 46, wherein said interlaced filamentary members comprise aramid fibers.

48. A sleeve according to Claim 32, further comprising an attachment piece engaging said sidewall, said attachment piece being adapted to attach said sleeve to a plurality of other said sleeves when said sleeves are arranged in overlying relation with one another, said attachment piece engaging sidewalls of said plurality of other sleeves.

49. A sleeve according to Claim 48, wherein said attachment piece comprises:

a first surface positioned in engagement with a sidewall of a first one of said sleeves;

a second surface positioned in engagement with a sidewall of a second one of one of said sleeves; and

a linking element extending through said sidewalls of said first and second sleeves and said sleeves positioned between said first and second sleeves, said linking element being attached to said first and second surfaces, said first and second surfaces being in substantially overlying relation with one another, said sidewalls being captured between said first and second surfaces.

50. A sleeve according to Claim 49, wherein said attachment piece comprises a grommet, said grommet comprising:

a tube extending through said sidewalls, said tube comprising said linking element;

a flange attached to one end of said tube, said flange being positioned in engagement with said one sidewall and comprising said first surface; and

a ring positioned in engagement with said other sidewall, said ring being in overlying relation with said flange and comprising said second surface, said tube having a lip engaging and attaching said ring in said overlying relation with said flange.

51. A sleeve according to Claim 50, wherein said lip is formed by cold-working said tube and forming an outward reverse fold therein.

52. A sleeve according to Claim 48, wherein said attachment piece comprises a suture positioned within

said sidewall and extending therethrough into engagement with at least another sidewall of another of said sleeves thereby attaching said sleeves to one another.

53. A sleeve according to Claim 48, wherein said attachment piece comprises a post extending through said sidewall and through another sidewall of another of said sleeves, a pair of cross pieces being attached at opposite ends of said post, said cross pieces engaging said sidewalls and retaining them to one another.

54. A sleeve according to Claim 53, further comprising a plurality of said posts and said cross pieces positioned in spaced relation lengthwise along said sidewalls of said plurality of sleeves and joining said sidewalls to one another, one of said posts and said cross pieces in each of said attachment pieces being frangible upon the application of a force separating said sleeves one from another.

55. An assembly for receiving elongated items, said assembly comprising:

a plurality of flexible sleeves, each said sleeve having a sidewall surrounding and defining a central space, opposing portions of said sidewall of each said sleeve being resiliently biased into facing relation with one another to assume a substantially flat configuration, said opposing sidewall portions being separable into spaced relation to receive said elongated items within said central space; and

an attachment piece extending through each of said sidewalls and attaching said sleeves to one another in overlying relation.

56. An assembly according to Claim 55, wherein said attachment piece comprises:

a first surface positioned in engagement with a sidewall of a first one of said sleeves;

a second surface positioned in engagement with a sidewall of a second one of one of said sleeves; and

a linking element extending through said sidewalls of said first and second sleeves and said sleeves positioned between said first and second sleeves, said linking element being attached to said first and second surfaces, said first and second surfaces being in substantially overlying relation with one another, said sidewalls being captured between said first and second surfaces.

57. An assembly according to Claim 56, wherein said attachment piece comprises a grommet, said grommet comprising:

a tube extending through said sidewalls, said tube comprising said linking element;

a flange attached to one end of said tube, said flange being positioned in engagement with said one sidewall and comprising said first surface; and

a ring positioned in engagement with said other sidewall, said ring being in overlying relation with said flange and comprising said second surface, said tube having a lip engaging and attaching said ring in said overlying relation with said flange.

58. An assembly according to Claim 55, wherein said attachment piece comprises a suture extending through said sidewalls of said sleeves and thereby sewing said sleeves to one another.

59. An assembly according to Claim 55, wherein said attachment piece comprises:
a post extending through said sidewalls of said sleeves;
a pair of cross pieces engaging a sidewall ends of said post;
one of said cross pieces engaging a
of a first one of said sleeves; and
another of said cross pieces engaging a
sidewall of a second one of one of said sleeves, said
post and said cross pieces holding said sleeves in said
overlying relation.

60. An assembly according to Claim 59, further comprising a plurality of said posts and said cross pieces positioned in spaced relation lengthwise along said sidewalls to one another, one of said posts and said cross pieces in each of said attachment pieces being frangible upon the application of a force separating said sleeves one from another.

61. An assembly according to Claim 55, wherein said sidewall of at least one of said sleeves comprises a plurality of interlaced filamentary members.

62. An assembly according to Claim 61, wherein said filamentary members comprise warp and fill yarns interlaced by weaving.

63. An assembly according to Claim 62, wherein said warp filaments are oriented lengthwise along said sidewall.

64. An assembly according to Claim 62, wherein said filamentary members are woven in a pattern selected from the group consisting of satin, sateen and twill weaves.

65. An assembly according to Claim 62, wherein said warp and fill yarns comprise polyester.

66. An assembly according to Claim 62, wherein said filamentary members comprise aramid filaments selected from the group consisting of nylon, polyphenylene sulfide, polyvinylidene fluoride, and copolymers of ethylene and chlorotrifluoroethylene.

67. An assembly according to Claim 55, further comprising a plurality of pull tapes, each one of said pull tapes being positioned within said central space of one of said sleeves, respectively, and extending substantially along the length thereof.

68. An assembly according to Claim 67, wherein each of said pull tapes has a substantially flat cross-sectional shape.

69. A sleeve according to Claim 67, wherein each of said pull tapes is formed of interlaced filamentary members.

70. A method of positioning and protecting elongated items within a duct, said method comprising the steps of:

providing a flexible sleeve comprised of a pair of opposed layers of woven resilient filaments comprised of warp yarns and a fill yarn common to both layers, said layers having a common seamless edge and a second edge, the layers being joined along the second edge by a knit stitch formed by interlooping of successive traverses of said fill yarn, said layers being of equal width and being resiliently separable from a first position in which they are in a closely spaced relationship to a spaced apart relationship in which a plurality of said elongated items may be accommodated, said layers being biased to return to said first position in the absence of any said elongated items, a pull tape being positioned between said layers and extending lengthwise along said sleeve; fixing an attachment device on an end of said sleeve;

drawing a line through said duct;

attaching one end of said line to said attachment device;

drawing said sleeve through said duct using said line;

severing said sleeve to remove said attachment device;

attaching said elongated item to one end of said pull tape; and

drawing said elongated item through said sleeve using said pull tape.